

Summary of PIER Kitchen Lighting Project and Relevance to PIER LRP Retrofit Downlight Project

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Introduction

This document is intended as an informal report on the current design status of the PIER funded Kitchen Lighting System and how this work feeds in the upcoming retrofit downlighting project. There have been a number of research and development activities throughout this R&D project that have provided strong background information for the retrofit project to follow. Though the Kitchen Lighting System is intended specifically for new construction, there have been, particularly in recent months, a number of developments that could be considered cross-over in nature. As the Kitchen Lighting System moves into a field testing phase, we feel we are now at an appropriate time to kick-off the retrofit project and initiate R&D activities for the PIER Lighting Research Program.

Kitchen Lighting System

The design of the Kitchen Lighting System (KLS) has evolved significantly since the project kick-off in June 2000. While the details of the design have changed, the core attributes of this system have remained the same. These attributes are:

System approach to optimize performance and minimize cost

- 2 lamp ballasts cuts ballast costs in half
- simplified materials: replace fixtures with “optical heads”

Builder friendly to reduce installation labor costs

- Plug and play wiring greatly reduces number of costly wire-nut connections
- Quick, simplified and flexible optical head mounting

Thermal protected electronic ballasting to ensure reliability

- Ballasting placed in locations that could be thermally optimized

Photometrically superior light output

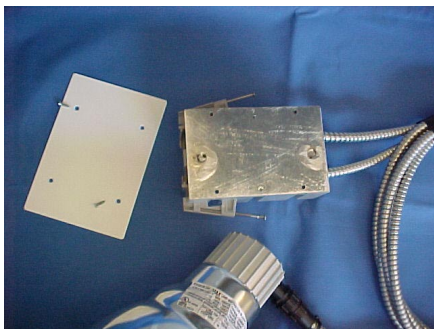
- High-quality, high-output electronically ballasted CFL
- High-efficiency, low-glare reflector optics

There are three system designs of the KLS that are now being produced and field-tested in new homes of several different builders with whom we have worked since the beginning of this project. SMUD has agreed to purchase enough of these production prototypes to provide lighting for 50 kitchens. The builders in turn have agreed to provide extensive feedback on the KLS, particularly on issues related to the installation of the system.

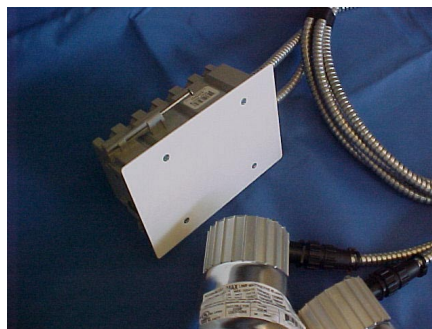
The three designs are described below. All three of these systems will have the following: UL listed, airtight (to maintain minimized heat and infiltration losses) and IC rated (for insulated ceiling environments.)

Option A

Single modular unit. Two downlights with a “visible” cover plate over ballast on room side. Cover plate is 4.75 x 6.87 and could be mounted on the ceiling or a wall. The ceiling or wall-mounted plate could be positioned in a closet, above the kitchen cabinets, above the cabinets in the ceiling, or any conditioned room area. Units can be daisy-chained by installer to make any even quantity (2, 4, 6, 8). Units can also be switched On in any even combination.



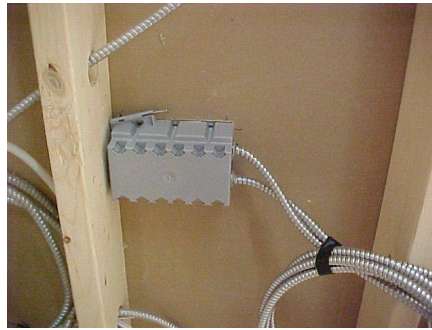
1. Cover removed. Ready for rough-in.



2. Cover installed after rooms are finished



3. Cover plate in ceiling with downlight

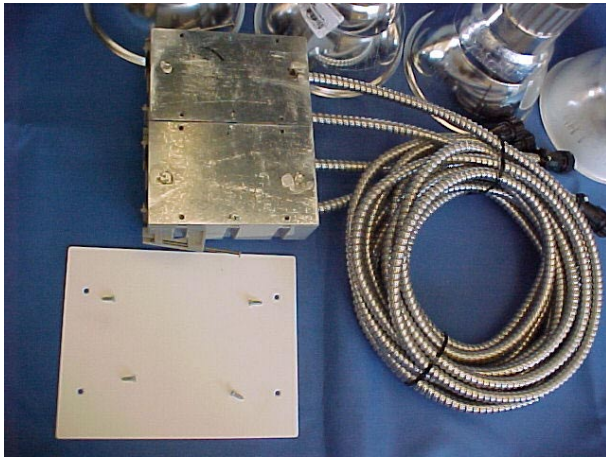


4. Back side of unit

Option B

Double modular unit. Four downlights with a “visible” cover plate over ballast on room side. Cover plate is 8.50 x 6.87 and could be mounted on the ceiling or wall. The ceiling or wall-mounted plate could be positioned in a closet, above the kitchen cabinets, above the cabinets in the ceiling, or any conditioned room area. Units can be daisy-chained by installer to make even quantities (4, 8, 12) or combined with the single unit (6, 10, 14). Units can also be switched On in any four downlight combination. Electrician is required to run power to the “cover plate” box for operation of four downlights.





1. Cover not installed during “rough in”.



2. Cover installed after rooms are finished

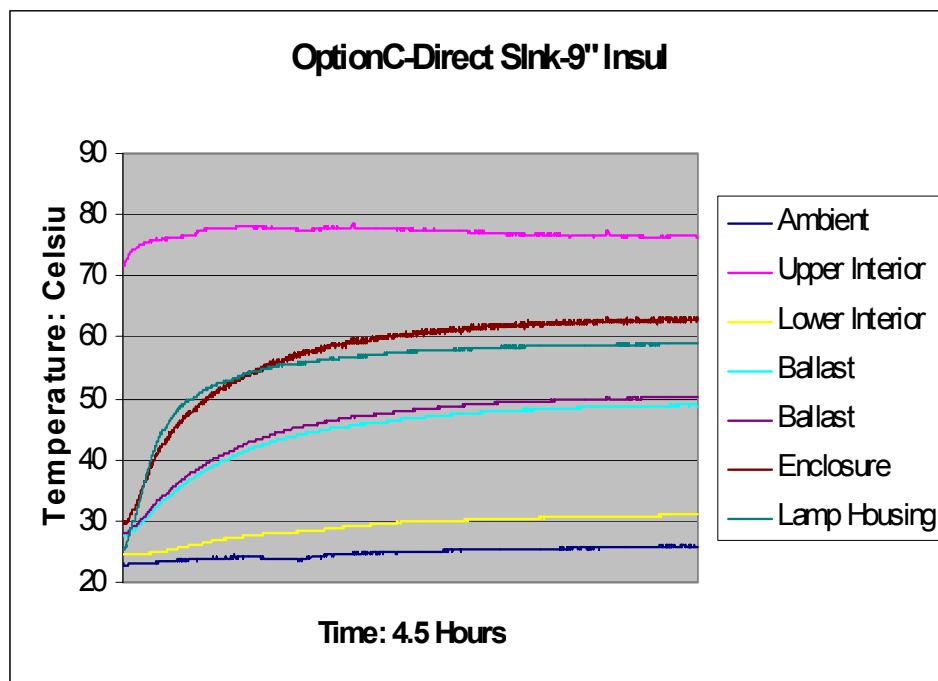
Option C

No visible cover plate is required for the system. The unit consists of a conventional downlight pan with a remote downlight. The remote downlight does not have a J-box and only requires the installer to plug in the flex conduit plug to the reflector and it is ready for operation. The electrician is required to run power to only one unit. Half the amount of labor is required. Units can be daisy-chained by the electrician to make even quantities (2, 4, 6, 8). Units can also be switched On in any even number downlight combination.





Much of the last several months on the KLS project has been devoted to thermal testing intended to determine operating characteristics of these three options. Extensive testing in environments approximating real world applications (a Sacramento attic space in August) has shown that each of these options can maintain the sensitive ballast circuitry well below its critical temperature. The figure below shows the output of one such test.



Retrofit Designs

The evolution of the designs of the KLS has presented us with some immediate opportunities for retrofit designs. We have already discussed hybrid designs of the options above that would be particularly well suited for retrofit environments. We have determined that existing one-story residence with attic access (initially estimated to be greater than 50% of existing housing stock) are prime candidates for these new retrofit designs. With attic access, a main, thermally protected ballast box can be wired to the existing kitchen circuit and the plug-and-play downlight whips can be strung to the desired downlight locations.

These retrofit systems are envisioned as an “out of the box” kitchen lighting systems that can go into kitchens that currently have incandescent downlighting as well as kitchens with no downlighting at all. This system has the potential to greatly reduce the wiring requirements for installation of a downlight system, which can be significant given the difficulties often encountered when working in confined attic spaces. This system also has great potential in two-story residences, though installation would likely be more evasive.

A limited amount of market data was collected on the retrofit market during the course of the KLS project. The exact size and potential of this market is not entirely known at this point, but it is thought to exceed that of new construction simply because the existing housing stock greatly exceeds the new housing market.

Data collected does include the following two key points:

- The most common retrofit/major renovation project is a kitchen remodel
- The most common aspect of a kitchen remodel is the installation of downlighting.